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Abstract

REACTOR SAFETY PRACTICE AND EXPERIENCE IN CANADA

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1. In Canada, the Atomic Energy Control Board is the regulatory agency in the field of atomic energy. It discharges its responsibilities for reactor safety with the assistance and advice of national and provincial departments of health and of labour, and of a Reactor Safety Advisory Committee. Canadian thinking and practice in regard to reactor safety has been greatly influenced by experience and research in the laboratories of Atomic Energy of Canada Limited.

2. Experience and experiment have led to such principles as: the "safety bank" or shutdown reserve, the use of redundancy in control systems to permit quick discovery and correction of faults, the use of moderator-level control with associated dump for emergency shutdown, the independence of regulatory and protective systems, the need for two independent trips for any possible control failure, provision of adequate emergency coolant for the fuel, and the requirement that emergency or stand-by devices should not remain idle or untested for long periods. The extension of some of these principles since the Second Geneva Conference is described.

3. In appraising the hazards of reactors, greater consideration is given to the probability of failures of components of the equipment that might lead to grave consequences, than to the number of casualties and other consequences of the "worst credible accident", because it directs attention to the causes of accidents and thereby promotes improvement in safety. Increasing attention is being given to determining unreliability of reactor equipment by observation of actual operation.

4. It is considered especially important that the process systems (including reactivity regulation), the automatic protective devices, and the containment provisions, be independent of one another so that the simultaneous failure of any two of them from the same cause is very improbable. The automatic protective equipment should be such that

any failure in the regulating system would not be expected to result in injury to any person inside or outside the plant. The containment provisions should be designed to prevent injury to persons outside the plant area if the regulating system, or other process equipment, and the automatic protective devices fail simultaneously. All equipment should be designed so that faults in parts or components can be discovered soon after they occur and corrected without delay.

5. Considerable experimental and development work has been done on containment provisions such as vapour suppression by water spray, and the automatic closure of the containment shell following a loss-of-coolant accident before the fuel can be overheated by decaying fission-product activity. Other safety problems that have been investigated experimentally include: damage from the accidental bursting of a coolant pressure tube in the reactor, the overheating of fuel elements, the behaviour of gaseous fission products in overheated oxide fuel, and the dispersal of fission products, if accidentally released, in the atmosphere, in the ground, and in rivers and lakes.

6. Advances in reactor safety and continuing experience in safe operation now encourage the location of reactors in somewhat more populated regions than formerly.